

## What are Tailings?

The purpose of this briefing is give a general overview of what tailings are and how they are disposed of in today's modern mining industry.

### Issue

1. Tailings are a by-product of mining;
2. Different amounts of water may be present in tailings facilities depending on the selected method of storage; and
3. Tailings facilities must be constructed in such a manner as to protect people, downstream property and the environment.

Tailings are generally contained in some type of impoundment, which is buttressed by a tailings dam. This paper is a brief introduction to methods used in storing tailings in engineered containment systems. A discussion of tailings dam construction is found in the SME Technical Paper "An Introduction to Tailings Facilities."

### Background

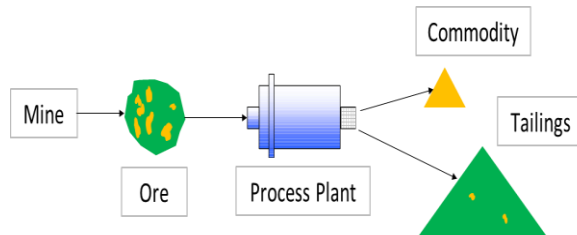
#### What are Tailings?

Tailings are a by-product of mining. After ore containing an economically-recoverable commodity is mined from the earth, that commodity is extracted in a processing plant or mill. After the commodity of value is extracted from the ore material, the resultant waste stream is termed "tailings". Typically, mill tailings range from sand to silt-clay in particle size.

Ore is material that contains a mineral commodity of value required to sustain modern life. Mineral commodities commonly recovered in the United States are copper, gold, silver, iron, lead, zinc, uranium and coal. The commodity, as a product, is sold and used to fabricate many things such as parts for a car, electrical cable for energy transmission and jewelry.

Due to a number of factors, not all of the commodity is recovered during the extraction process and some residual commodity usually remains. Thus, the tailings may become valuable in the future depending on technological improvements and market conditions allowing them to be reprocessed.

The diagram below outlines the basic sequence of mining, processing, and tailings generation in separating the final commodity product from the ore body.



## How are Tailings Stored?

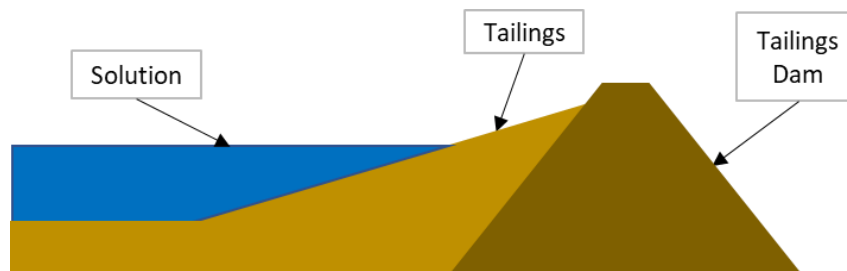
After processing, tailings are impounded so that their effect on the environment is minimized. There are several methods currently used in the mining industry for constructing tailings facilities, including:

1. Conventional tailings facility, including in-pit disposal methods;
2. Paste tailings including underground backfill; and
3. Filtered tailings.

Each of these tailings impoundments utilizes a dam and engineered containment to minimize seepage of solutions into the environment. Generally, a pump system is used to collect any errant seepage and return it to the process or impoundment.

### **Conventional Tailings Facility**

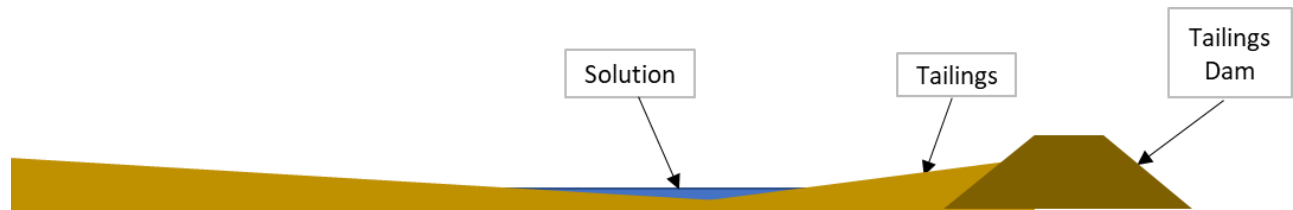
Tailings slurry, typically containing 1 to 2 parts of finely ground solids to 1 to 2 part of water, is pumped or otherwise conveyed directly to a tailings facility, which consists of a dam and an engineered containment system. Solution decants (is poured) from the solids and is usually recycled back to the processing plant.



A variation of this type of tailings facility would be the placement of tailings into all or a portion of a mined-out pit. As with other methods, care is taken to account for any migration of contaminants that may occur. On some occasions, backfilling a pit with tailings can reduce or eliminate the production of acid rock drainage from the pit walls.

### **Paste Facility**

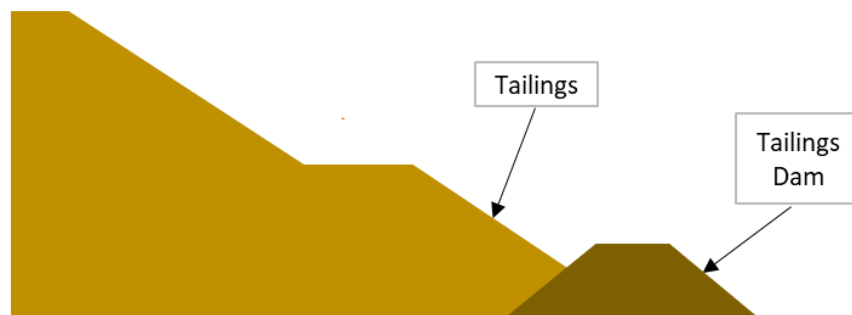
In the final process before storage, water is separated from tailings slurry in special tanks called thickeners to make a “paste”. Depending on the amount of water in the tailings, usually less than 1 part of water to 3 parts of finely ground solids, the resultant material may have the texture of toothpaste. The paste is pumped to a storage facility. There usually is a small amount of decant solution that is pumped back to the process.



Sometimes paste and cement are mixed and pumped back into an underground mine for storage, which actually helps the miners by filling voids and providing ground support. It also reduces the amount of area on the surface that would be used for the paste tailings facility.

### **Filtered Tailings**

Tailings are pumped into high pressure filters that produce a rinsed filter cake product containing about 1 part water to 5 parts of finely ground solids. The filter cake can be transported by conveyors or trucks and stacked in a tailings facility. Usually, the size of the starter dam required to ensure slope stability is much smaller than conventional tailings facilities, but is highly project-specific. Ideally, there is usually very little solution left in the tailings, which may be moved and shaped in a pile by mechanical equipment such as bulldozers. A protective organic cover may be added after placement to effectively seal the tailings in a ground structure that may grow vegetation.



## Who Regulates Tailings Storage?

All modern tailings facilities must submit and obtain local, state and federal regulatory approval of an operating, closure and remediation plan. Tailings management during mine operation and afterward are the responsibility of mining companies. Government agencies regulate tailings and set minimum design standards. Tailings management and storage facilities are engineering projects which comply with safety and environmental control requirements. Water management and dust management are also important considerations.

## SME Statement of Technical Position

1. SME recognizes tailings management and storage as an essential part of the mining process.
2. The selection of an appropriate tailings disposal method is site specific and there are no one-size-fits-all technologies. The tailings disposal method should be selected based on various factors, including site topography, climate, environmental factors, regulatory guidance, corporate policies, and land constraints, among others.
3. Technological improvements in recent years have provided several different methods for constructing tailings management facilities to minimize environmental impact, water usage and dust generation.
4. Tailings management facilities must be designed, constructed, operated, and closed subject to the appropriate government regulatory oversight to minimize the risk to communities and the environment.

## References

Mine Tailings Storage: Safety is No Accident, United Nations Environment Programme, 2017, ISBN: 978-82-7701-170-7, Pages 20 – 21

Stability of Tailings Dams Focus on Numerical Modeling – 2011, Mechanical Properties of Fine Grained, Sulphur Rich, Silty Soils, Muhammad Auchar Zardari, 2010

Tailings Paste Disposal – More Than Water Recovery, S. Slottee, March 2011, SME Annual Meeting Proceedings

Filtered Dry Stack Tailings – The Fundamentals, Dr. Michael Davis, Proceedings Tailings and Mine Waste 2011, Vancouver, BC

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<sup>i</sup> A list of all technical briefing papers is available on the SME web site at <https://www.smenet.org/What-We-Do/Technical-Briefings>